Federal Energy Technology Center

Enterprise Architecture

Final Report
August 31, 1999

Submitted by the IATI Team

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Executive Sponsor Approval

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Background

Introduction

This is the final report of the Information Architecture Transition to Implementation (IATI) Team. Feedback provided by executive board members in response to the IATI's interim report has been received and processed. The report is also responsive to the Director's memorandum to the IATI Team of May 6, 1999. The purpose of the IATI Team as defined by our charter is to lay out a structure to move from our current information environment to an environment in line with the Enterprise Architecture (EA) Framework. This report focuses on solutions to three critical issues: Information Technology (IT)/Business Integration, Disjointed and Duplicative Systems, and Information Reliability.

The Enterprise Architecture is an important tool for achieving FETC's Institutional Goal 3: Manage for Results. The body of work and knowledge assembled by FETC's architecture teams provides a firm foundation on which FETC can build a solid information infrastructure. Several of the products developed by the architecture teams are currently being used by the organization. Examples include IRMD's use of the EA Methodology for information systems development, purchase and deployment of Goldmine Enterprise software to meet FETC's PeopleBank requirements, the use of the Investment Management Process to assist in setting FY2000 system priorities, and the various uses across the organization of the Key Processes and Enterprise Hubs.

Purpose of EA

The purpose of FETC's Enterprise Architecture is to meet stakeholders needs through improved organizational performance. EA improves performance through:

- Aligning FETC's information, applications, data and technology with our mission and goals.
- Providing a framework to perform process improvement, in the context of FETC's seven Enterprise Hubs as defined in the Strategic Structural Model. The Enterprise Hubs, where information flow intersects with key processes, are identified as Product, Project, Institutional, Financial, External Relationships, Facilities, and Human Resources.

EA Vision

It is envisioned that FETC is an organization where:

- Shared information is the foundation of the FETC's activities.
- We share and communicate information in a way that supports effective decision-making at all levels of the organization.
- Needed information is readily accessible in a format usable and meaningful to the user.
- Individuals do not hoard information, but recognize it as a Center-wide resource.

Benefits of EA

- Provides a structure in which FETC can manage its information and processes.
- Ensures that our information and technology support the business.
- Focuses systems development toward organizational needs, not individual desires.
- Leads to improved information quality.
- Leads to more efficient and effective information system development.

Drivers

Our organization has many challenges facing it as we enter the 21st century. Effective performance of our business mission must occur in conjunction with achieving our strategic goals. The FETC business model is complex, with many Key Stakeholder groups to satisfy.

In facing and responding to these challenges, information is one of FETC's most important resources. FETC's products and services often come in the form of information. Our effective management of information and its use in synthesizing new knowledge products is critical for our success. Key to the management of this information is the establishment of a structure by which information can be managed. This structure is the Enterprise Architecture.

Cultural Premise

Steven Spewak, DOE's EA Consultant, states that EA thrives in organizations with certain attributes. Organizational attributes conducive to EA include:

- Senior Management supports and understands the value of the Enterprise Architecture.
- Organization has strategic and tactical goals and plans.
- Information is recognized as a significant resource.
- Organization is committed to continuous improvement.
- Documented processes and policies are followed with a disciplined approach.
- Organization fosters a cooperative team atmosphere.
- Resource expenditures are managed as investments.

Implementation

Issues

The IATI Team defined several issues that were hampering organizational performance. We prioritized the issues and focused on addressing the following:

1. **IT/Business Integration** - FETC has no entity officially responsible for coordinating the integration of business requirements and information technology solutions.

2. **Disjointed and Duplicative Systems -** Our current information systems are disjointed and in some cases functionality is duplicated. Solutions are developed to support one part of the organization, rather than the whole organization.

3. **Information Reliability -** It is often difficult to obtain the needed information for decision making or external reporting. Information is often in an unusable format, located in multiple places, and of uncertain quality.

The IATI Team believes that if these critical issues are addressed, FETC will make significant progress toward Enterprise Architecture implementation. Recommended approaches and solutions for the issues are provided in the next section.

Approach and Solution

IT/Business Integration -- Microsoft's white paper *Enterprise Architecture Essentials: Achieving Business Value with IT* notes that information technology and its alignment with the business is a responsibility of both business and information technology personnel. Emphasized by the paper are instances where "artificial walls based on false assumptions" are placed between the two, resulting in information technology solutions which don't meet the business needs. Neither group, by themselves, can attain the desired result.

An approach to this issue is assigning a single entity with the responsibility of aligning information technology solutions with business needs and facilitating communication between the appropriate parties. The IATI Team believes an EA Team composed of both business and information technology professionals can best perform this activity. The structure, membership, responsibilities and reporting structure for the EA Team is provided in Appendix 1. An alternative to the EA Team would be a single person in the position of a Chief Information Officer (CIO). The CIO would have the same objectives and responsibilities as the EA Team. Appendix 2 provides a comparison of a CIO versus an EA Team. Implementing some combination of the two may also be a viable approach.

We believe the correct solution to this issue is to assign the EA Team as the single entity responsible for facilitating the communication of business requirements and technology solutions.

Disjointed and Duplicative Systems -- Information systems developed to meet the need of an individual or sub-component of an organization without taking into consideration the needs and impact of the whole organization often fall woefully short of optimizing organization performance. The result is disjointed and duplicative systems that often require manual manipulation of multiple pieces of data to attain

usable information. It is imperative that we move information technology development to doing that which benefits the organization most.

The IATI Team developed the EA Investment Management Process to address this issue. The EA Investment Management Process provides a structured approach to evaluating and managing information system projects. Appendix 3 provides a brief explanation of this process.

We believe the solution for this issue is the routine and consistent use of the EA Investment Management Process.

Information Reliability -- Information relied on for decision making must be easily located and freely available to the organization.

The IATI Team developed policies and tools to address this issue. The policies are shown in Appendix 4 and, if followed, should result in higher degree of information integrity. Appendix 5 provides a list of tools such as the IA Framework, Enterprise Architecture Methodology, etc., for use in managing the EA.

We believe the solution to this issue is the disciplined implementation of the policies in combination with using the EA tools.

Recommended Actions

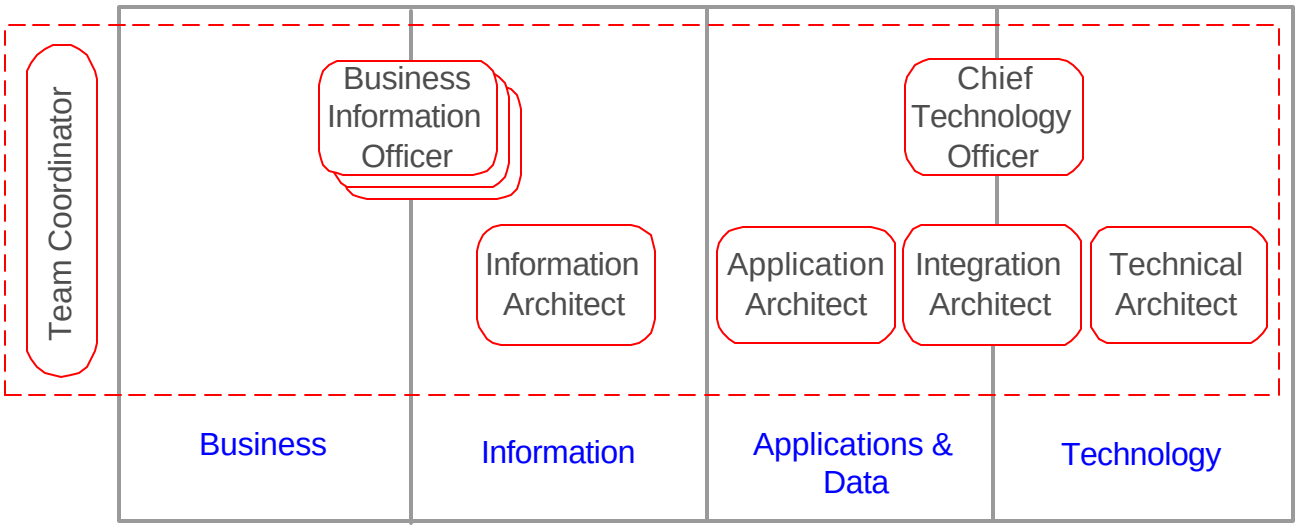
To accelerate the adoption of the EA Framework and to set forth a structure to move from our current information environment to an environment in line with the EA Framework, the IATI Team recommends the following actions:

1. Establish an EA Team as the single entity to manage IT/business integration.
2. Use the EA Investment Management Process.
3. Support a disciplined approach to implement the developed policies and use the EA Tools.
4. Have patience.

EA Team: Where Business and Technology Meet

EA emphasizes a holistic framework of people, process, and technology intensely focused on achieving business goals and objectives. The value of Enterprise Architecture is not in any one individual perspective (business, application, information or technology), but in the relationships, interactions, and dependencies among perspectives. The IATI Team believes that the best way to attain this perspective is through a team of business and information technology professionals. The EA Team was designed with this objective in mind. The EA Team structure recognizes that EA is not an IRM function or a Business function, but requires both working in concert to achieve the desired result.

EA Team Diagram



The accountability table below provides the responsibilities of the EA Team, the expertise that team members bring to the team, and the reporting structure of the team and the individual members.

Accountability Table

EA Team (Reports to FETC Director) Carries out the EA Investment Management Process, providing input to FETC's institutional planning process Aligns FETC's information, applications, data and technology with FETC's mission and goals Ensures that information management and business operations are integrated Addresses overlaps or conflicts between the processes Ensures standards for the EA are defined and followed Develops, updates and shares EA Tools, processes and vocabulary	**Business Information Officer** (Reports to direct supervisor and Enterprise Hub ADs) Represents the business needs, business processes, and information required by those processes to the EA Team Responsible for ensuring business process models exists for their Enterprise Hub Responsible for performance of the systems within their Enterprise Hub
	Chief Technology Officer (Reports to OPSSO AD) Performs information technology forecasting and strategic planning Performs scheduling, budgeting, and resource allocation to ensure the availability of the technology infrastructure Optimizes utilization of technology resources, with a focus on meeting the business needs of the FETC
	Information Architect (Reports to MCD DD) Keeps the information architecture framework current Performs current state assessments for the enterprise systems Ensures integration of business drivers with requirements
	Application Architect (Report to IRM DD) Manages FETC's information systems development process Oversees information system testing Performs scheduling, budgeting, and resource allocation to ensure the development of EA applications
	Integration Architect (Report to IRM DD) Drives the integration of FETC's enterprise systems, including legacy systems, databases, technology interfaces, and middleware adapters. Leads the implementation of the middleware component
	Technical Architect (Reports to IRM DD) Manages FETC's information technology infrastructure Leads a collaborative design and implementation process
	EA Team Coordinator (Report to direct supervisor and FETC Director) Schedules, manages and facilitates the team meetings Serves as the primary point of contact between the FETC Executive Sponsor and the EA Team

NOTE: The responsibilities performed by the individual roles on the team exist (or should exist) in the normal functioning of the center.

Enterprise Architecture Team vs. Chief Information Officer

The characteristic advantages for selecting either a CIO or an EA Team to coordinate IT/business integration are presented in this appendix. The IATI Team believes it is critical to ensure these responsibilities are performed. The responsibilities for this single entity are:

1. Management

Manage Enterprise Architecture
Manage allocation of resources based on organizational needs not individual needs
Manage/Perform EA Investment Management Process
Manage resolution of enterprise hub conflicts

CIO advantages:

- Single person with clear responsibilities
- More responsive that multi-person team

EA Team advantages:

- Provides checks and balances among enterprise hubs
- Broad based business expertise
- Provides long term continuity
- Conflict resolution based on business needs

2. Integration

Ensure technical solutions are driven by business needs
Ensure information is shared throughout the organization
Ensure alignment of FETC's information technology with FETC's mission and goals

CIO advantages:

- Provides a single vision

EA Team advantages:

- Teaming facilitates sharing
- Team has more contacts throughout the organization

3. Planning

Performs long range planning necessary to achieve the EA vision

CIO advantages:

- Provides a single focus
- More responsive to Executive Board

EA Team advantages:

- Team members already involved in institutional and long range planning for enterprise hubs

4. Communication

Advises the executive board on EA issues, including input to the institutional planning process
Promote EA as part of FETC's culture
Promote understanding of business processes
Promote and provide guidance for stewardship
Develop, update, document, and share EA tools, processes, and vocabulary

CIO advantages:

- Single focal point for promoting issues and processes
- Single point of responsibility

EA Team advantages:

- Broad organizational representation
- Strong enterprise hub orientation
- Sharing of information occurs more inherently with teams

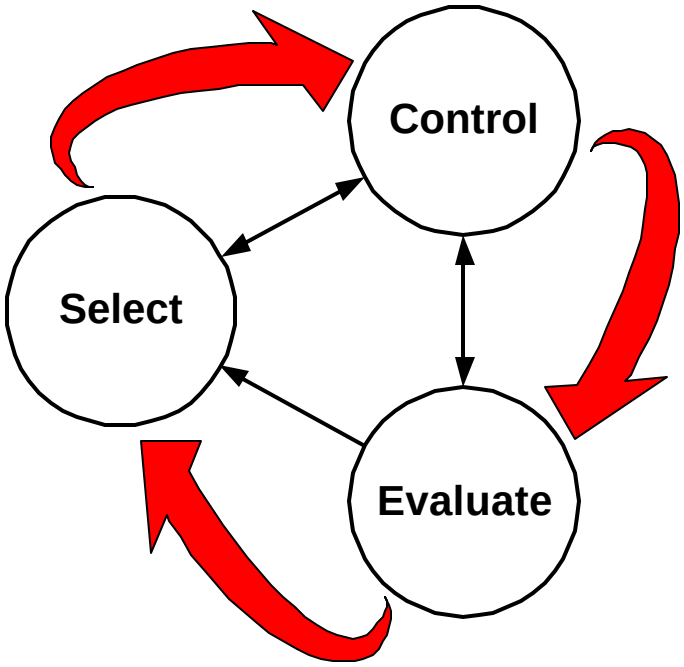
EA Investment Management Process

A key function of the Enterprise Architecture is determining where best to invest available resources. The EA Investment Management Process is an integrated approach to managing information investments that provides for the continuous identification, selection, control, life-cycle management, and evaluation of the investments. This structured process provides a systematic method for FETC to minimize risks while maximizing the return on the investments.

The EA Investment Management Process is based upon a GAO guide titled *Assessing Risks and Returns: A Guide for Evaluating Federal Agencies' IT Investment Decision-making*. A significant benefit to adopting the GAO guide as the starting point for FETC's decision making tool is that the GAO guide conforms to laws, directives, and policies.

The EA Investment Management Process has three essential phases--select, control, and evaluate. Each phase is conducted as part of a continual, interdependent management effort, not as a separate step. Outcomes from one phase are used to support activities in the next phases. The following figure illustrates the three phases and the relationships between the phases.

Fundamental Phases in the EA Investment Management Process



The EA Investment Management Process should be used to analyze the entire portfolio of EA systems, encompassing new systems, proposed modifications, and existing systems. Use of the process in this way will provide a solid foundation for keeping, stopping, transforming, or replacing information systems and technology. In addition, the analysis

assists in technical infrastructure planning and helps to ensure the integrity of the organization's Enterprise Architecture.

Selection

The EA Investment Management Process begins with the Selection phase. In this phase, FETC determines priorities and makes decisions about which projects will be funded during the year. The IATI recommends that selection occur on a annual basis (aligned with the annual institutional planning process), with less thorough quarterly reviews.

Both proposed and ongoing projects enter in to the process, which examines the existing inventory of systems and applications to review existing costs, benefits, and risks associated with all other investments. Selection decisions are made based on an analysis of where needs are greatest and in line with the organization's retirements and replacement plans and implementation strategy.

The Selection phase helps ensure that the organization (1) selects those projects that will best support mission needs and (2) identifies and analyzes a project's risks and proposed benefits before a significant amount of project funds are spent. A critical aspect of this phase is management understanding and participation and decision-making that is driven by accurate, up-to-date data and an emphasis on using enterprise architecture to enhance mission performance. Once selected, all of the projects in the portfolio are consistently controlled and managed. Progress reviews, in which the progress of projects are compared against projected cost, schedule, and expected mission benefits, are conducted at key milestones in each projects life cycle. The type and frequency of these reviews are usually determined based on the analyses of risk, complexity, and cost that went into selecting the project. If a project is late, over cost, or not meeting performance expectations, senior executives decide whether it should be continued, modified, or canceled.

Control

The Control phase helps ensure that as a project is developed and investment costs rise, that the project continues to meet mission needs, and if it does not or if problems have arisen, mitigating steps are quickly taken to address the deficiencies. Decisions made at the Control phase may include canceling the project, modifying it to better meet mission requirements, accelerating development of the project, or continuing its development as planned.

Evaluate

In the Evaluate phase, actual versus expected results are evaluated to (1) assess the project's impact on mission performance, (2) identify any changes or modifications to the project that may be needed, and (3) revise the investment management processes based on lessons that were learned.

Recommended Policies

FETC Organization Policies	Purpose/Value/Why?	NIST Pyramid
A policy will be needed which establishes the philosophy that information is a key organization resource and as such open access to that information should be the rule rather than the exception.	Take advantage of and share appropriately FETC's information that resides throughout the organization.	Information
To ensure stewardship responsibilities are accepted, feedback to the assigned stewards is required. This feedback may occur through the 360 degree review process	A single point of responsibility for process and information aid accuracy and cuts down on confusion (finger pointing) over who is responsible. The feedback will help the stewards improve performance.	Business Information
A policy will be needed outlining how FETC manages its information system portfolio. It will be through this policy that FETC will establish EA priorities and resource needs	To increase FETC's return on resources invested. Should insure EA investments are aimed at meeting business needs	Enterprise
Enterprise Architecture Policies		
There should not be one "all encompassing" information system. Because different parts of the FETC organization have different information needs, there should different systems which through their interconnection meet FETC information needs.	Modular components offer a greater return, fit and flexibility than investing in one large enterprise system.	Enterprise
Since no information system is truly a "stand-alone" system, all information system development needs to be coordinated through some FETC entity.	Information is more valuable to FETC when shared. Systems must be implemented with information sharing in mind.	Enterprise Application
Business processes and information used by those processes as well as applications will have a steward to act as a focus for activities associated with their responsibility	A single point of responsibility for process aids in accuracy and cuts down on confusion (finger pointing) over who is responsible.	Business Information

Supporting Documents

The following documents support the IATI Team's recommendations and should in many cases be useful in carrying out these recommendations. The documents are available upon request from Mark Estel (Mgn x4085).

Document Title	Content
IATI Interim Report	EA Investment Management Process; EA Team Structure
IAPT Final Report	IA Framework, including**:** Strategic IA Structural Model, Key Processes, Major Information Categories, and FETC's Business Model
FETC Enterprise Architecture Methodology	Defines a common approach to system development. Addresses the make versus buy decision process
FY2000 Enterprise Systems Investments	First application of the selection phase of the EA Investment management tool at FETC. Provides results and recommended process improvements
External EA Drivers	Lists of laws, orders and directives that required information management structure
Technical EA Policies	List of information technology EA policies
Enterprise Architecture FY2000: Input to CORE Planning Team	Provides summary, Status and analysis of FETC's EA Activities
FETC Sub-Process List	Sub processes, based on Key Processes
Eastman Chemical Interviews	Discusses the importance of a defined tool to help in setting enterprise system priorities. Eastman Chemical has process stewards throughout the organization
NTIS: Information Management Directions - The Integration Challenge	Enterprise Architecture Pyramid
An Architectural Approach to Delivering Distributed Enterprise Application: TRC Inc.	TRC's Reference Architecture and Delivery Models support the EA Team structure, e.g., separate Application, Information, Integration, and Technical architects.
Microsoft White Paper: Enterprise Architecture Essentials: Achieving Business Value with IT	White paper argues for removing the "artificial wall" between business and IRM personnel, the multiple architectural perspective (NIST Pyramid). Discusses dynamic process between reactive versus proactive EA implementation.
Extending and formalizing the framework for information systems architecture - Sowa & Zachman	The father of all Enterprise Architecture frameworks. Highly regarded. Argues that a complex structure requires multiple views to be fully understood.
Arthur Anderson Global Best Practices -- Process Classification Scheme	The starting point from which the FETC Key processes was derived.
Software Testing Plan – People Bank	Description of the steps needed to address the software requirements. These also helped in deciding which of the two systems would best fulfill the user requirements.
Software Requirements Matrix – People Bank	The software requirements compiled from the user interviews.
Enterprise Systems Life Cycle Diagram for Software Engineering	This is a Visio diagram that describes the steps which Enterprise Systems will use to develop systems.
Software Design Document for GoldMine 4.0– People Bank	This document describes how the user requirements will be implemented using the chosen tool.
IBM Information Systems Planning Guide	The methodology adopted in developing the Strategic Structural Model